CLAIMS

1. A trending system for trending data from a physical system, the trending system comprising:

   a sliding window filter, the sliding window filter receiving a data set from the physical system, the data set comprising a plurality of data points, the sliding window filter selecting multiple data windows in the data set, with each of the data windows including a subset plurality of the data points in the data set, the sliding window filter generating upper confidence bounds and lower confidence bounds for each data point using each of the multiple data windows that includes the data point, the sliding window filter selecting an upper confidence bound and a lower confidence bound for each data point that results in the smallest confidence interval for that data point.

2. The system of claim 1 wherein the sliding window filter outputs a filtered estimate of the data set.

3. The system of claim 1 wherein the sliding window filter determines the upper confidence bounds and lower confidence bounds through linear regression and statistical inference of the data set.

4. The system of claim 3 wherein the sliding window filter performs the statistical inference using Student-t statistics.

5. The system of claim 1 further comprising a trend change detection mechanism, the trend change detection mechanism determining a first convex hull for a set of upper confidence bounds and a second convex hull for a set of lower confidence bounds, the extrapolation mechanism comparing the first convex hull and the second convex hull to determining a transition point in the data set, the extrapolation mechanism determining an estimated trend of the data set based on the transition point and the set of upper confidence bounds and the set of lower confidence bounds.

6. The system of claim 5 wherein the trend change detection mechanism compares the first convex hull to the second convex hull by determining if the first convex hull and the second convex hull intersect.

7. The system of claim 5 wherein the trend change detection mechanism compares the first convex hull and the second convex hull to determine a transition point in the data stream by determining if the first convex hull and the second convex hull intersect, and by iteratively discarding points in the data set and generating a new first convex hull and a new second convex hull until there is no intersection between the new first convex hull and the new second convex hull.

8. The system of claim 1 wherein the trending system further comprises an outlier elimination mechanism, the outlier elimination mechanism removing statistical outliers in the data set by generating a first prediction cone for data points in a left sample window, generating a second prediction cone for data points in a right sample window, and determining if data points in a test window reside in the first prediction cone and the second prediction cone.

9. The system of claim 8 wherein the outlier elimination mechanism generates the first prediction cone and the second prediction cone by linear regression of the data points in the left sample window and linear regression of the data points in the right sample window.

10. The system of claim 9 wherein the outlier elimination mechanism moves the left sample window, right sample window, and test window through the data set to remove outliers through out the data set.

11. The system of claim 8 wherein the outlier elimination mechanism determines outliers by a weighted reciprocal of confidence intervals generated by prediction cones.

12. The system of claim 1 wherein adjacent windows in the multiple data windows overlap in the data set.

13. The system of claim 1 wherein the physical system comprises an aircraft system.

14. A method of trending data from a physical system, the method comprising the steps of:

    a) receiving, from the physical system, a data set comprising a plurality of data points;

    b) selecting multiple data windows in the data set, each of the data windows including a subset plurality of data points;

    c) generating upper confidence bounds and lower confidence bounds for each of the data points using each of the multiple data windows that includes the data point; and

    d) selecting an upper confidence bound and a lower confidence bound for each data point that results in the smallest confidence interval.

15. The method of claim 14 further comprising the step of generating a filtered estimate of the data set from the selected upper confidence bounds lower confidence bounds for each data point.

16. The method of claim 14 wherein the step of generating upper confidence bounds and lower confidence bounds comprises generating through a linear regression and statistical inference.

17. The method of claim 16 wherein the statistical inference comprises using student-t statistics.

18. The method of claim 14 further comprising the step of generating a first convex hull from a first set of upper confidence bounds generating a second convex hull from a second set of lower confidence bounds, and further comprising the step determining a transition point in the data set from the first convex hull and the second convex hull.

19. The method of claim 18 wherein the step of determining a transition point in the data stream from the first convex hull and the second convex hull comprises determining if the first convex hull and the second convex hull intersect.

20. The method of claim 18 wherein the step of determining a transition point in the data stream from the first convex hull and the second convex hull comprises comparing the first convex hull to the second convex hull to determine if the first convex hull and the second convex hull intersect, and further comprises iteratively discarding points in the data set and generating a new first convex full and a second new convex full until there is no intersection between the first new convex hull and the second new convex hull.

21. The method of claim 14 further comprising the step of removing outlier data from the data stream by generating a first prediction cone for data points in a left sample window, generating a second prediction cone for data points in a right sample window, and determining if data points in a test window reside in the first prediction cone and the second prediction cone.

22. The method of claim 21 wherein the first prediction cone and the second prediction cone are generated by linear regression of the data points in the left sample window and linear regression of the data points in the right sample window.

23. The method of claim 21 comprising the step of moving the left sample window, right sample window and test window through the data set to remove outliers through out the data set.

24. The method of claim 14 wherein adjacent windows in the multiple data windows overlap in the data set.

25. The method of claim 14 wherein the physical system comprises an aircraft system.

26. A program product comprising:

a) a trending program, the trending program including:

a sliding window filter, the sliding window filter receiving a data set from the physical system, the data set comprising a plurality of data points, the sliding window filter selecting multiple data windows in the data set, with each of the data windows including a subset plurality of the data points in the data set, the sliding window filter generating upper confidence bounds and lower confidence bounds for each data point using each of the multiple data windows that includes the data point, the sliding window filter selecting an upper confidence bound and a lower confidence bound for each data point that results in the smallest confidence interval for that data point; and

b) signal bearing media bearing said trending program.

27. The program product of claim 26 wherein the signal bearing media comprises recordable media.

28. The program product of claim 26 wherein the signal bearing media comprises transmission media.

29. The program product of claim 26 wherein the sliding window filter outputs a filtered estimate of the data set.

30. The program product of claim 26 wherein the sliding window filter determines the upper confidence bounds and lower confidence bounds through linear regression and statistical inference of the data set.

31. The program product of claim 30 wherein the sliding window filter performs the statistical inference using Student-t statistics.

32. The program product of claim 26 wherein the trending program further comprises a trend change detection mechanism, the trend change detection mechanism determining a first convex hull for a set of upper confidence bounds and a second convex hull for a set of lower confidence bounds, the extrapolation mechanism comparing the first convex hull and the second convex hull to determining a transition point in the data set, the extrapolation mechanism determining an estimated trend of the data set based on the transition point and the set of upper confidence bounds and the set of lower confidence bounds.

33. The program product of claim 32 wherein the trend change detection mechanism compares the first convex hull to the second convex hull by determining if the first convex hull and the second convex hull intersect.

34. The program product of claim 32 wherein the trend change detection mechanism compares the first convex hull and the second convex hull to determine a transition point in the data stream by determining if the first convex hull and the second convex hull intersect, and by iteratively discarding points in the data set and generating a new first convex hull and a new second convex hull until there is no intersection between the new first convex hull and the new second convex hull.

35. The program product of claim 26 wherein the trending program further comprises an outlier elimination mechanism, the outlier elimination mechanism removing statistical outliers in the data set by generating a first prediction cone for data points in a left sample window, generating a second prediction cone for data points in a right sample window, and determining if data points in a test window reside in the first prediction cone and the second prediction cone.

36. The program product of claim 35 wherein the outlier elimination mechanism generates the first prediction cone and the second prediction cone by linear regression of the data points in the left sample window and linear regression of the data points in the right sample window.

37. The program product of claim 36 wherein the outlier elimination mechanism moves the left sample window, right sample window, and test window through the data set to remove outliers through out the data set.

38. The program product of claim 35 wherein the outlier elimination mechanism determines outliers by a weighted reciprocal of confidence intervals generated by prediction cones.

39. The program product of claim 26 wherein adjacent windows in the multiple data windows overlap in the data set.

40. The program product of claim 26 wherein the physical system comprises an aircraft system.